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Kwon et al.

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(54) **PORTABLE WORK LIGHT**

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(51) **Int. Cl.**

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F21V 15/01	(2006.01)
F21V 7/00	(2006.01)
F21V 31/00	(2006.01)

(52) **U.S. Cl.**
CPC ***F21V 31/005*** (2013.01); ***F21V 7/00*** (2013.01); ***F21V 15/01*** (2013.01)

(58) **Field of Classification Search**
CPC F21V 31/005; F21V 15/01; F21V 7/00
See application file for complete search history.

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(57) **ABSTRACT**

A reduced emissions work light composed of a two module system for easy assembly and reassembly of component parts. The first module includes a bulb, a ballast, a ballast housing, an end cap, a socket fixture, and an electrical cable. A socket fixture is configured to secure a connection between the ballast housing and the bulb to create a single unitary body. The first module is placed inside a second module to form the reduced emissions work light containing only two separate components.

20 Claims, 15 Drawing Sheets

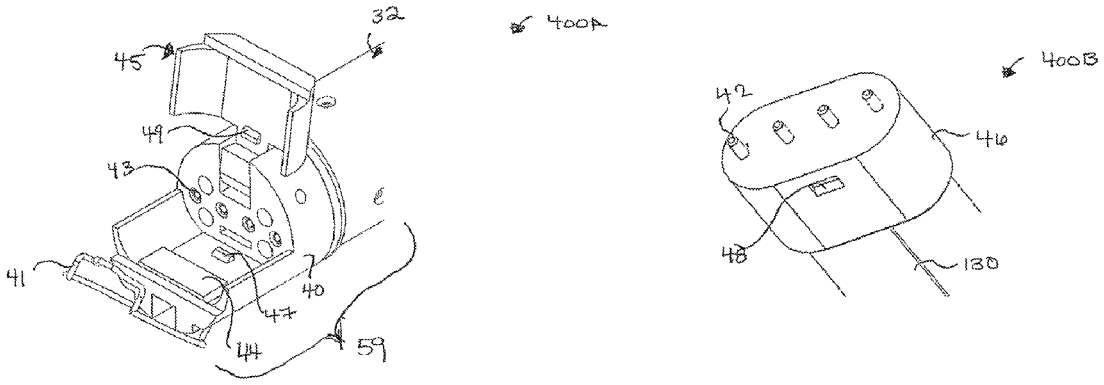


FIG. 1

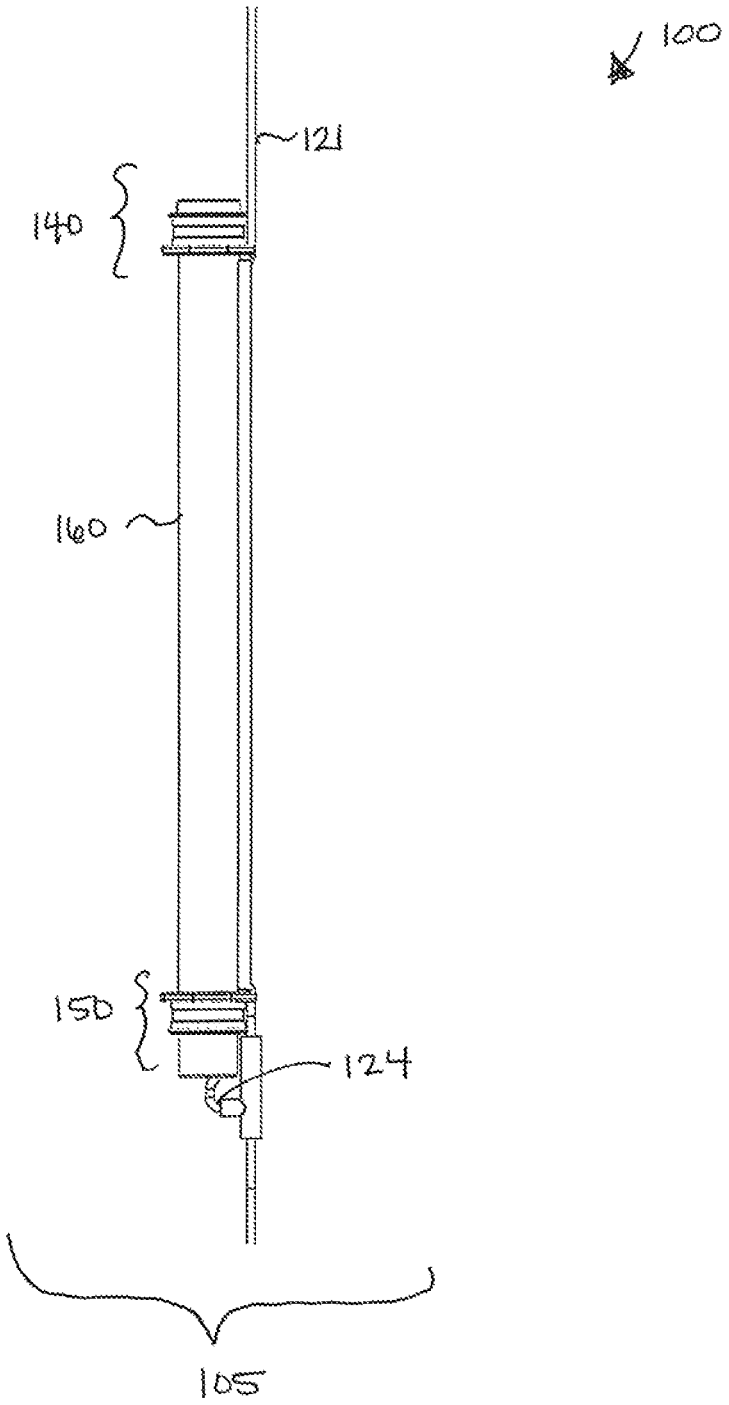


FIG. 2

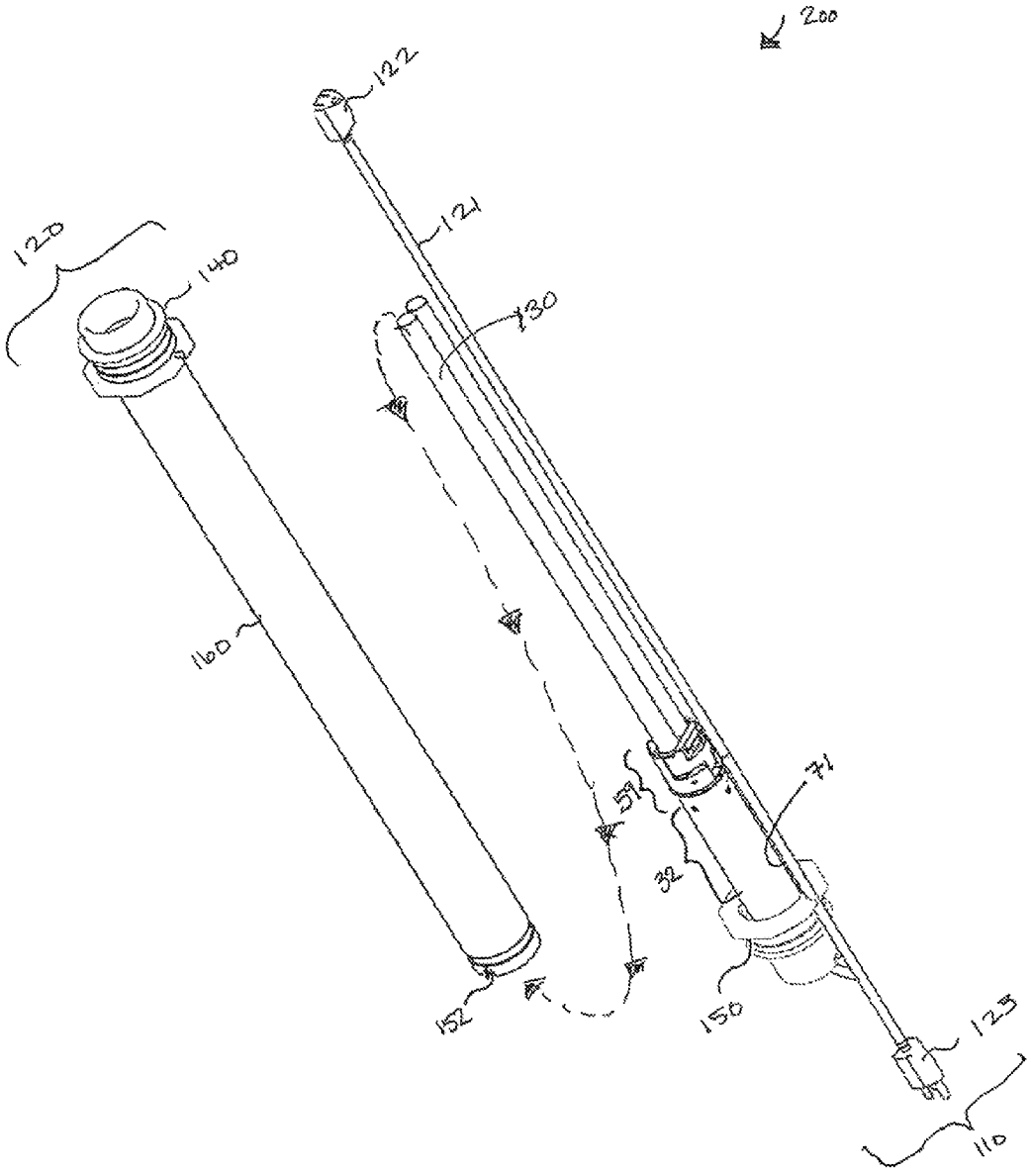


FIG. 3

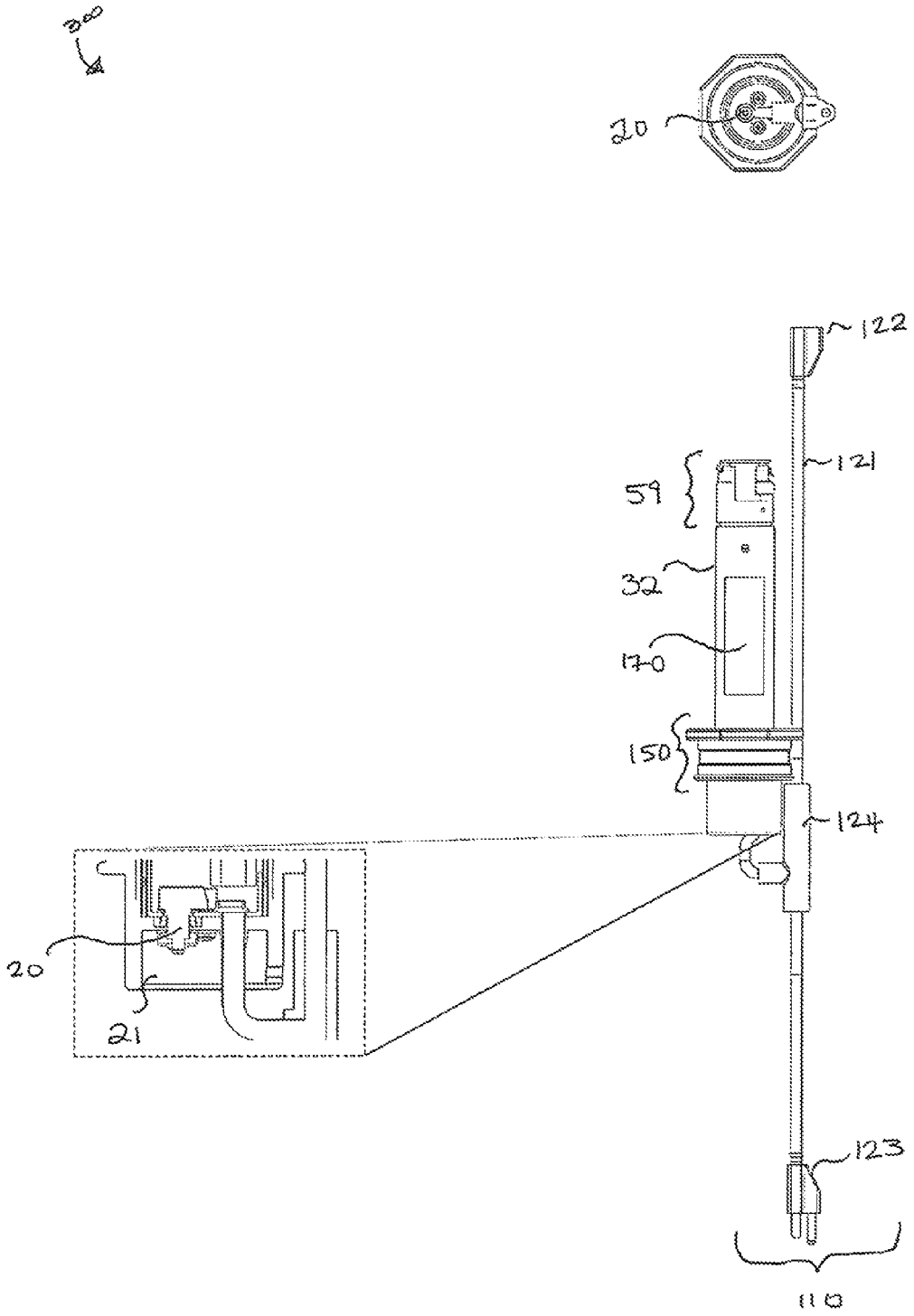


FIG. 4(A)

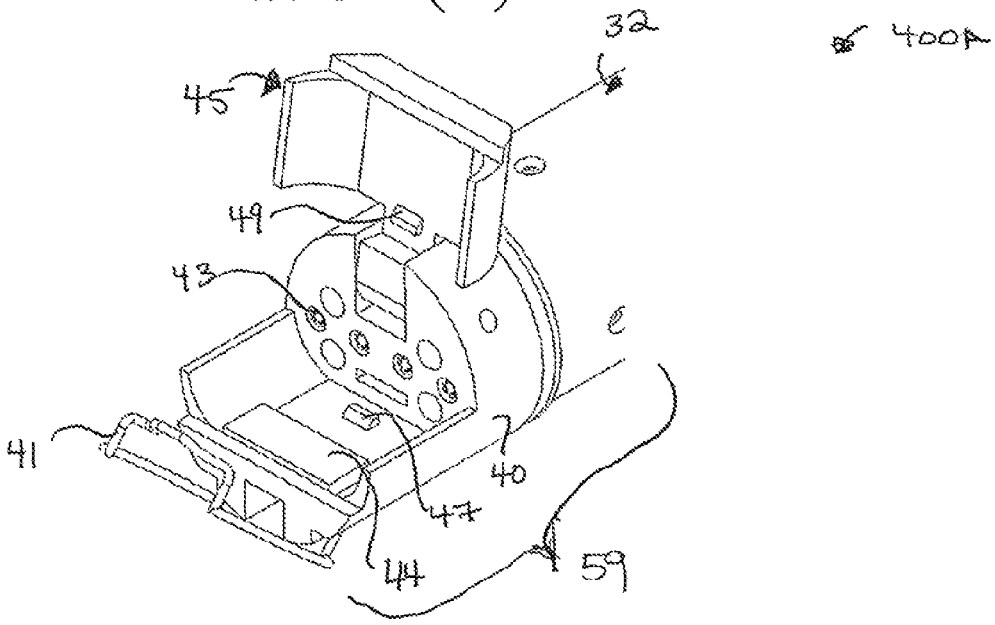


FIG. 4(B)

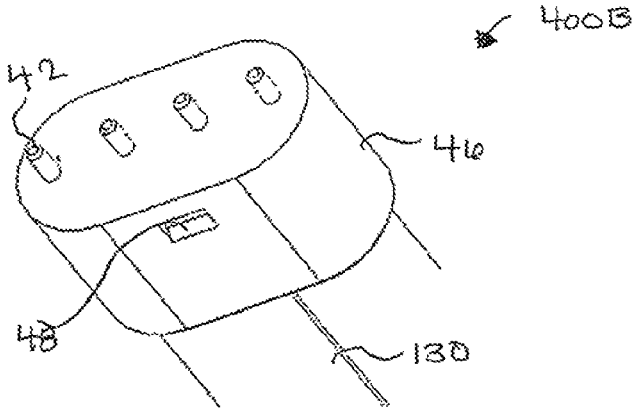


FIG. 4(C)

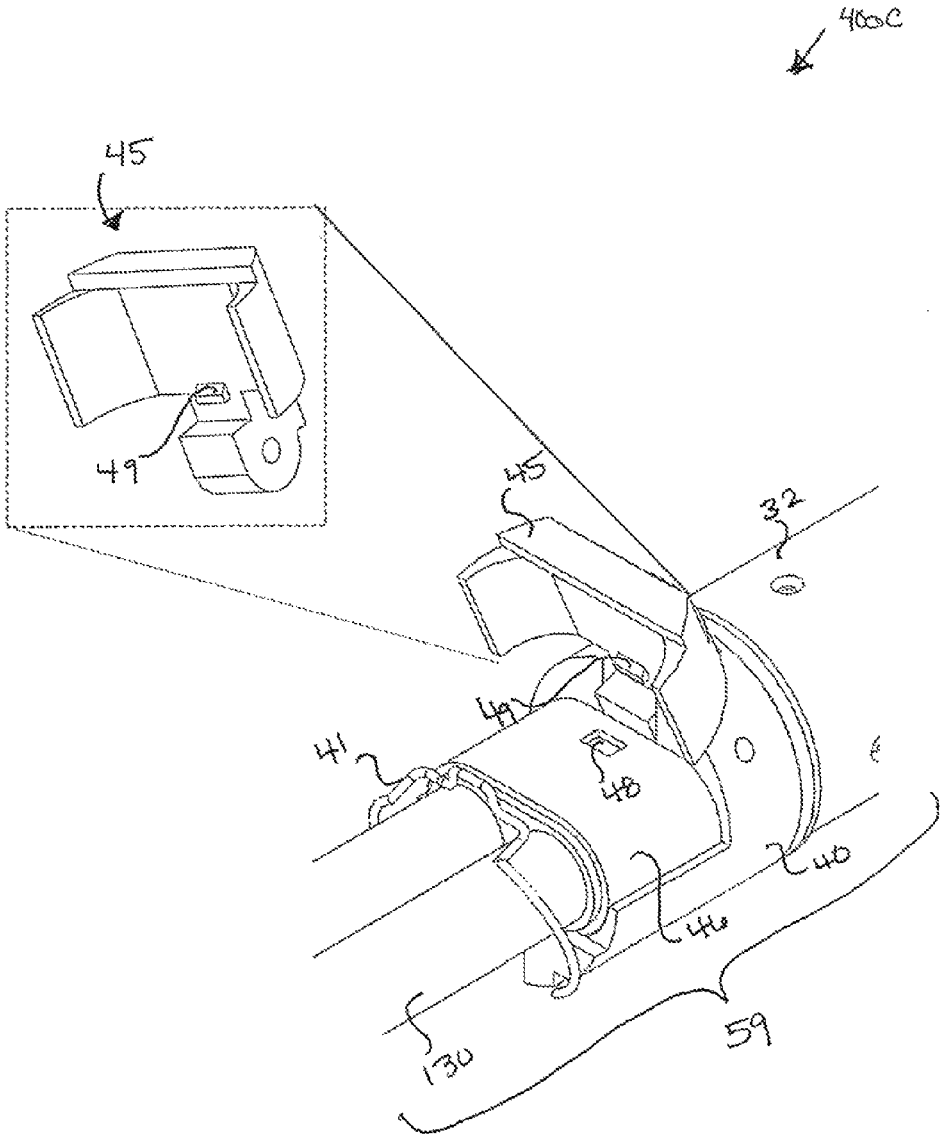


FIG. 4(D)

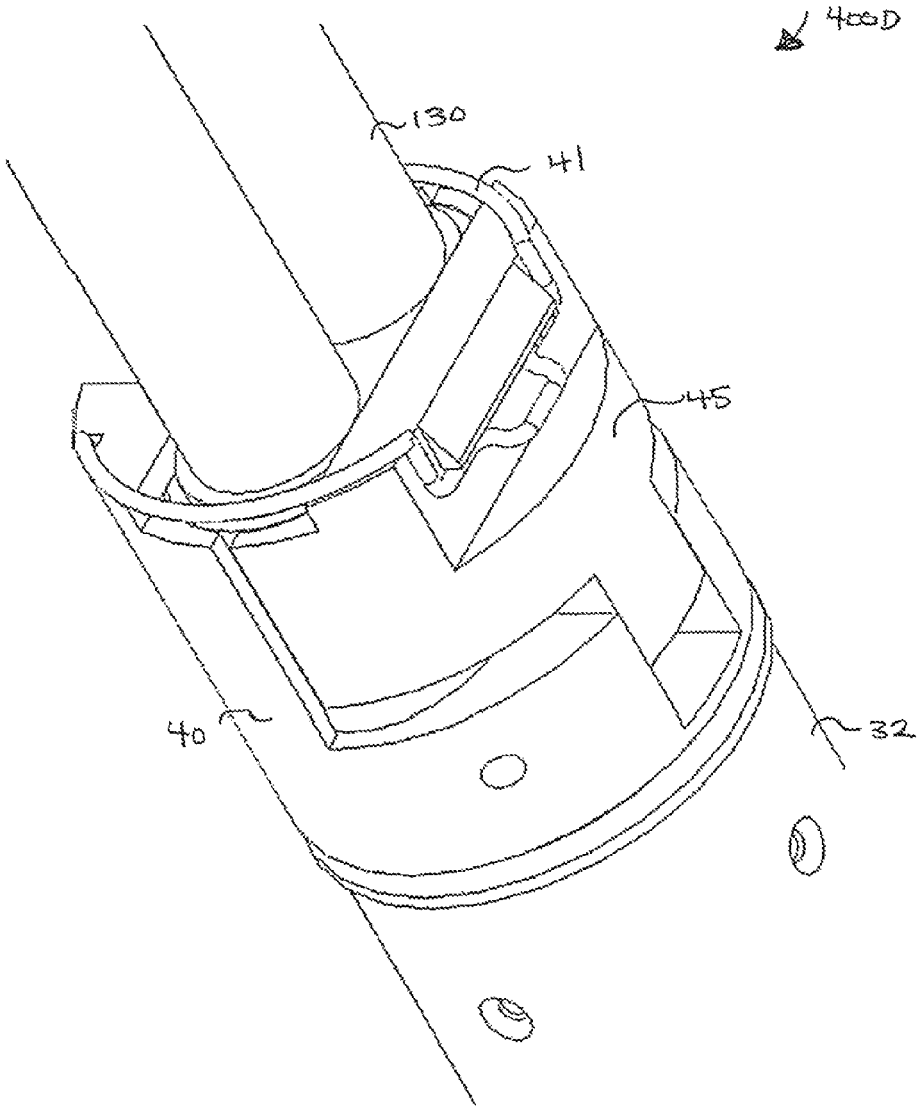


FIG. 5(A)

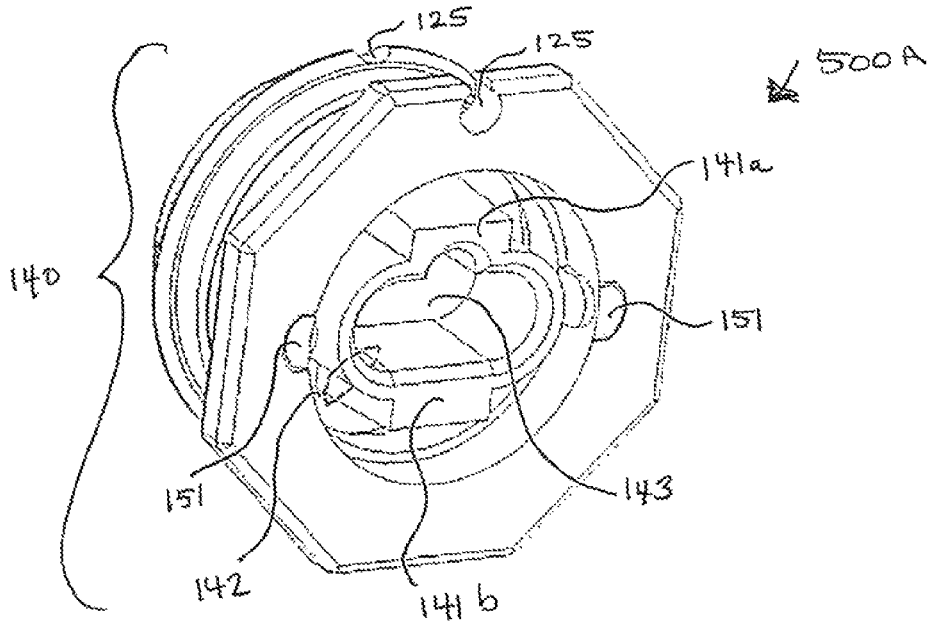

125
125
500A
141a
140
151
151
143
142
141b

FIG. 5(B)

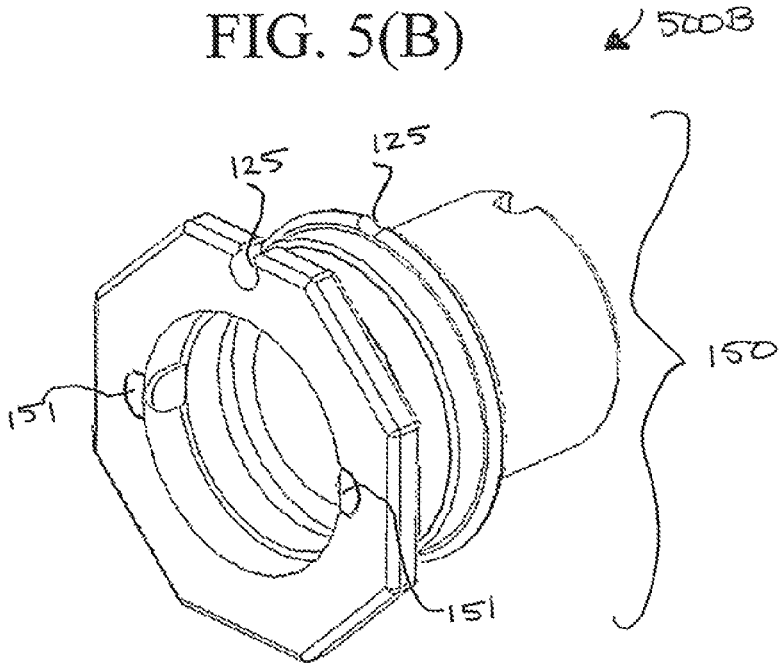

500B
125
125
150
151
151

FIG. 6

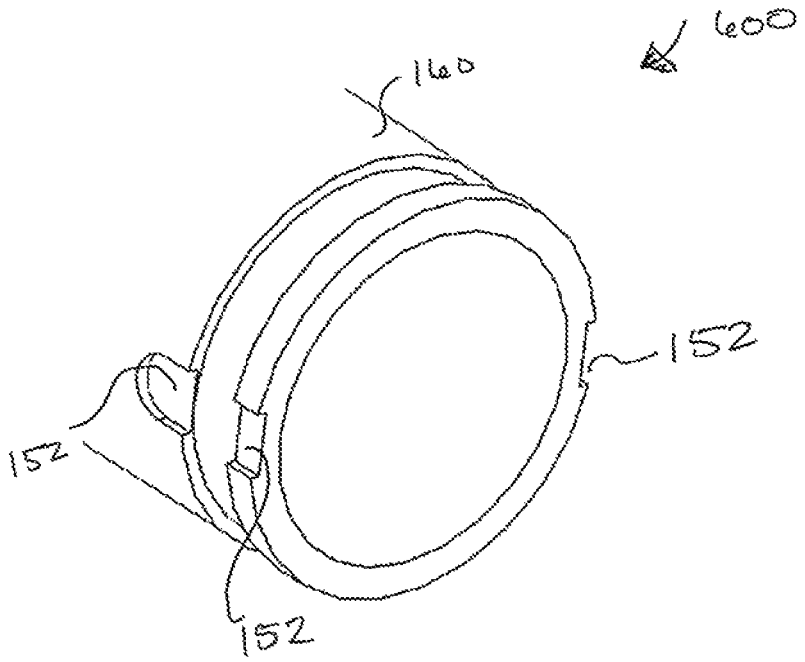


FIG. 7

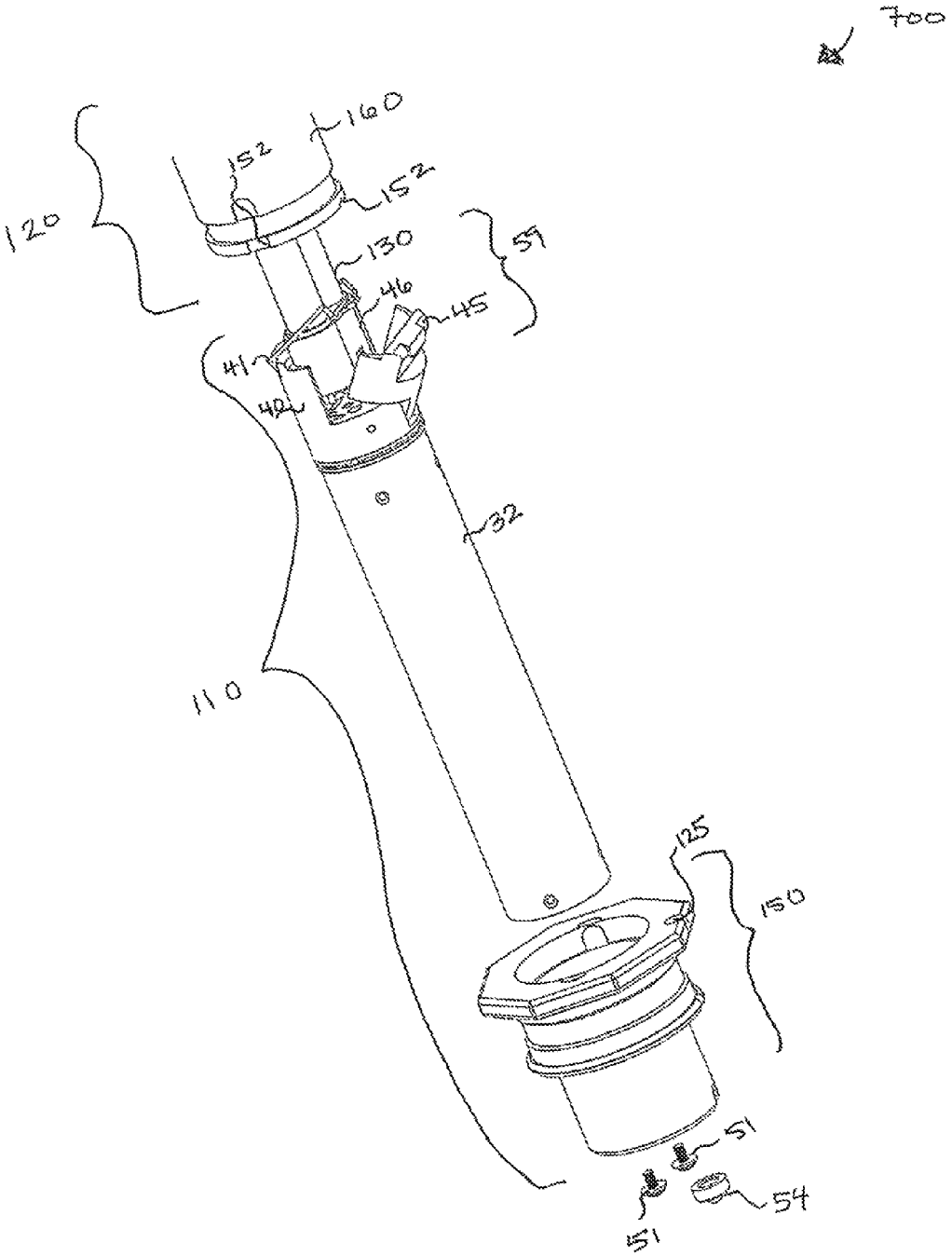


FIG. 8

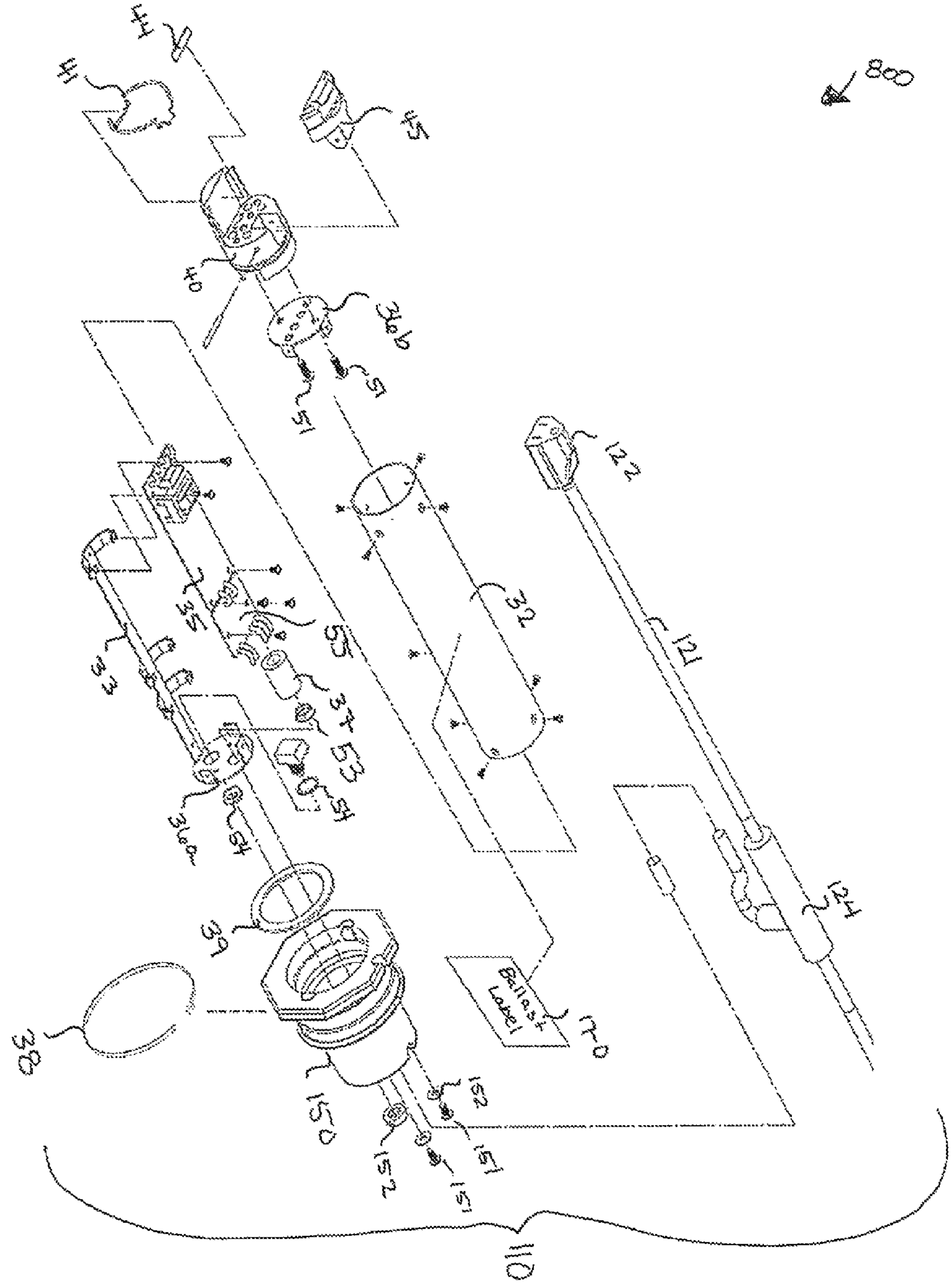


FIG. 9

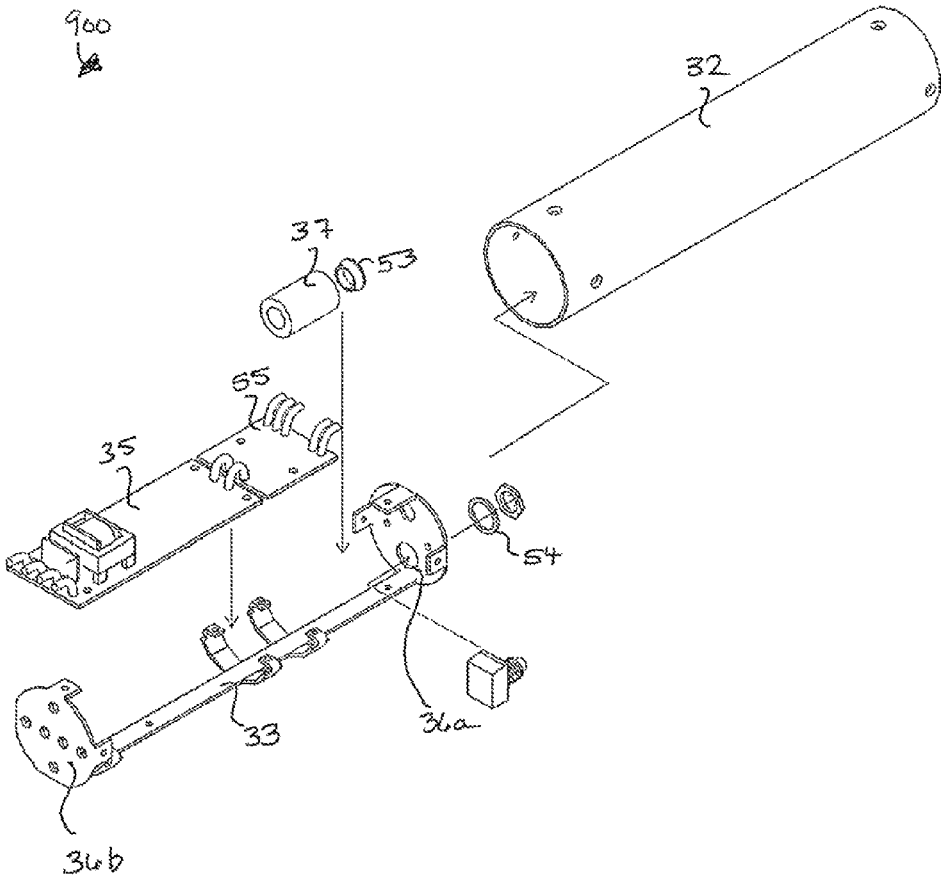


FIG. 10(A)

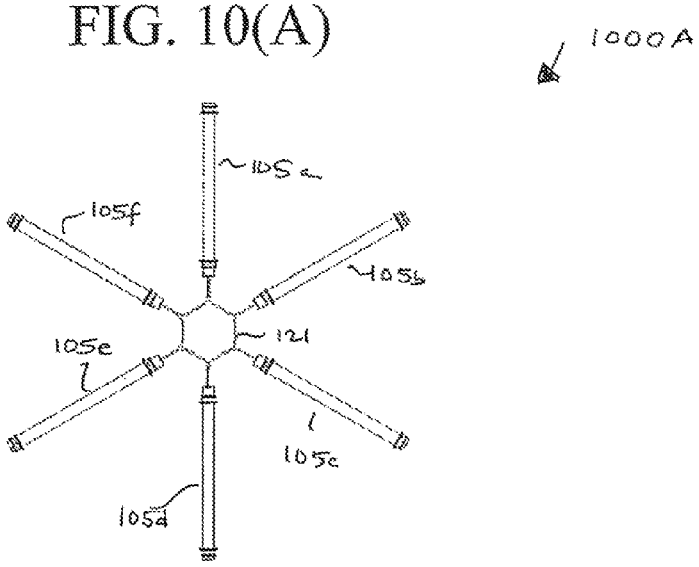


FIG. 10(B)

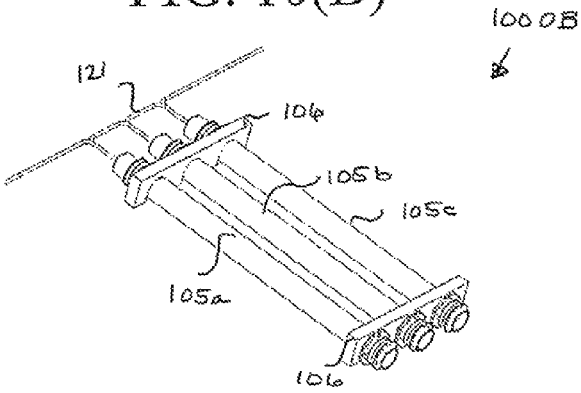


FIG. 10(C)

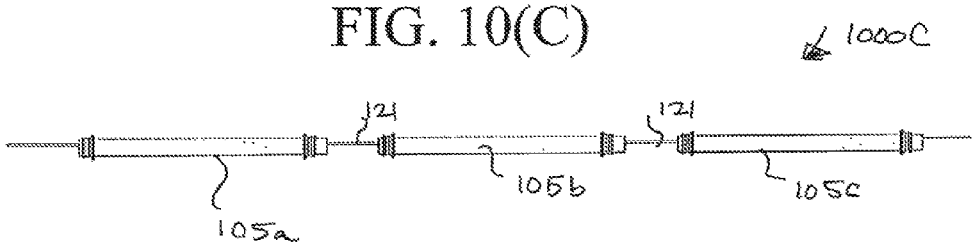
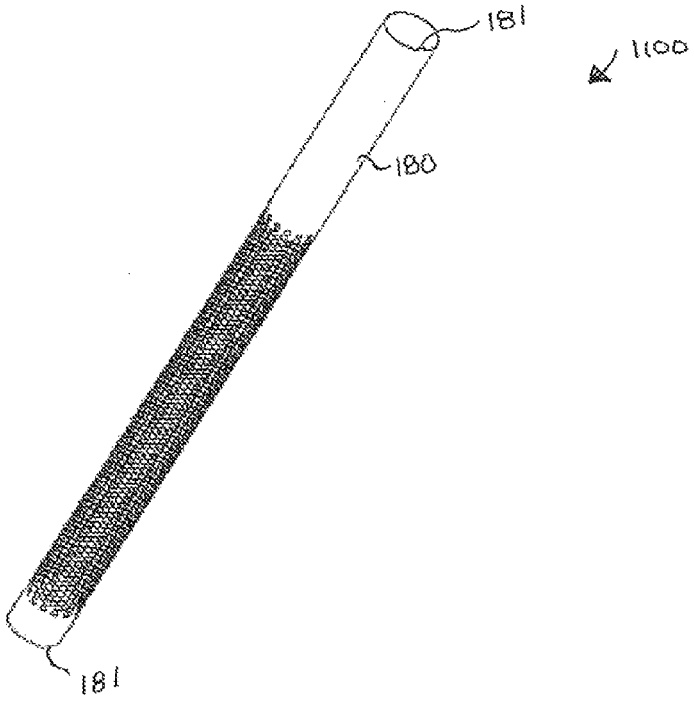


FIG. 11



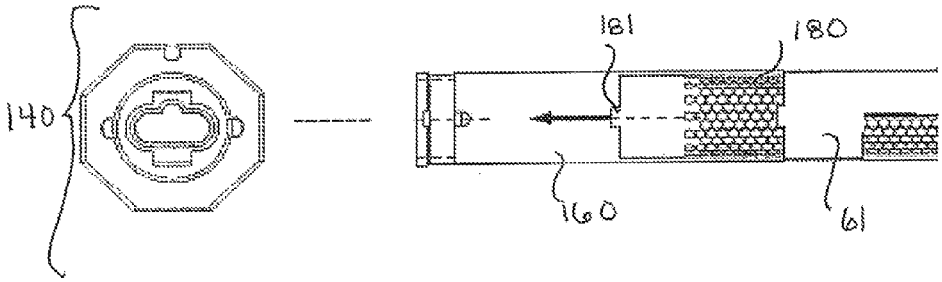


FIG. 12

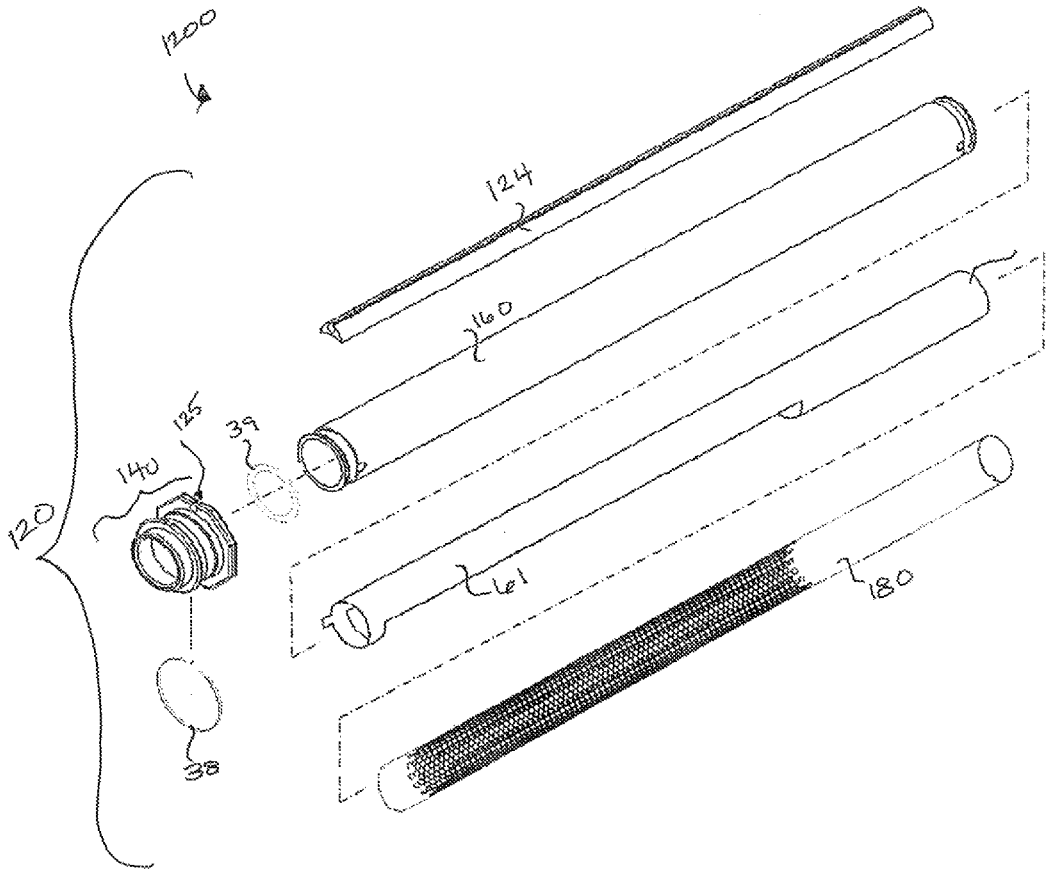
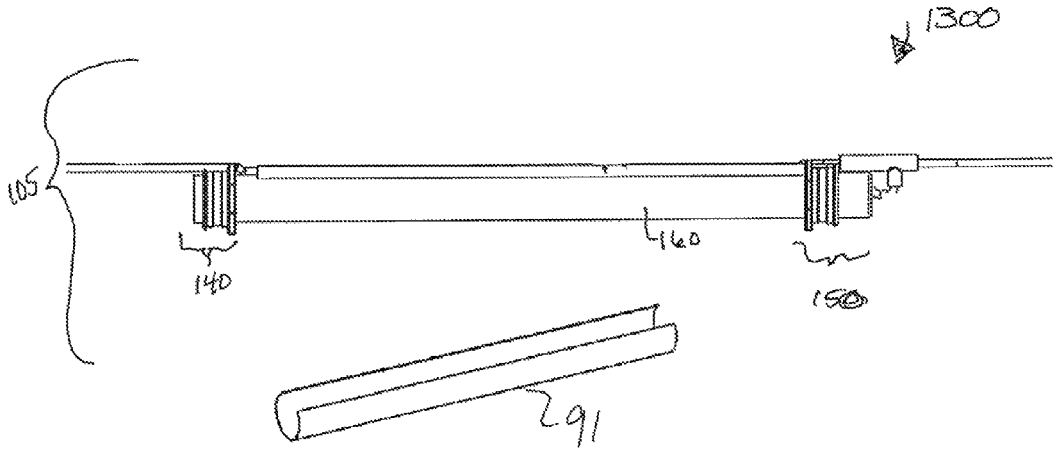


FIG. 13



PORTABLE WORK LIGHT

BACKGROUND OF THE INVENTION

This invention relates to a portable light or light set capable of interconnection with multiple light sets of the same or similar construction to be easily assembled and disassembled for use in modular conditions. The invention is particularly focused toward military and defense organizations used to transport and repair the light set in difficult conditions. Current portable light(s), light sets, or work lights suffer from disadvantages related to time and effort in disassembling and reassembling components for replacements or repairs of interconnected components.

SUMMARY OF THE INVENTION

The present invention will become more fully understood from the detailed description given herein below and the accompanying drawings, which are given by illustration only, and thus are not limitative of the present invention, and wherein:

Therefore, it is an object of example embodiments of the present invention to provide a work light that is able to overcome the deficiencies noted in the current art.

The portable light of the present invention is configured to provide high intensity, lightweight lighting, of flexible usage, rugged construction, extreme durability, and include easily replaceable components. The portable lights may be used in mobile situations that require easy and fast set-up and break-down. For example, the portable light may be used with the Tent, Extendable, Modular, Personnel (TEMPER) and Modular, Command Post, Systems (MCPS) as used in military operations.

Example embodiments of the present invention include a light set and components thereof capable of storage in extreme high and low temperatures and humidity without defect. A portable light configured to withstand external and internal vibrations and shocks and be configured to operate at low noise levels to provide for use in sensitive areas.

The portable light(s) of the present invention, also referred to herein as work lights or light fixtures, are configured to enable ease of use by containing two main structures. Example embodiments of the present invention include a light fixture consisting of at least two modules. By having the modules connected, the manufacturing process and the set-up and break-down processes are more efficient and simplified. The interconnection between the at least two modules enables easier replacement of internal components, for example, enabling a user to more quickly and safely replace a bulb (or lamp) within a housing of the light set. Fewer steps are necessary to replace a component based on the two-module system of the present invention. Further example embodiments of the present invention allow for a clamp-style socket that secures the connection between the socket and the lamp. Such clamp-style sockets hold the lamp in place, and make the lamp, ballast, cap, and cable into a single module.

Further example embodiments of the present invention include a pad, such as a rubber pad, placed on or around the socket in order to prevent slippage and to absorb internal and external forces acting upon the modules. The locking clamp-style socket is configured to use multiple different lamp bases from different manufacturers, thereby enabling a user to intermix components with ease. Further example embodiments of the present invention include a spring clip that is configured to provide tension and absorb both internal and external forces, such as impact, shock, or vibration that could damage the modules or the lamp.

Further example embodiments of the present invention include a clamp and socket configured to be locked together using different components, for example, by rubber band, spring, VELCRO®, or electrical tape. The portable light can be attached in multiple configurations. For example, the assemblies could be serially attached, radially attached, or attached in parallel. In different configurations, the portable light in a series are configured such that each bulb can be controlled individually or such that a string of portable lights or at least a part of the entirety may be controlled as a group.

A U-shaped cable conduit is made with flexible material to hold a power cable. The cable conduit is attached on a plastic tube and capable of easy installation and removal. Example embodiments of the present invention further include an internal guide that enables a user to quickly and efficiently remove or install a new bulb by allowing a user to align the portions of the module (e.g., rubber caps, lamp, tube and ballast) in the proper orientation.

The two end caps, lamp, tube, and ballast are aligned at assembly or reassembly of the apparatus. The guide is further provided to ease the manufacturing process by enabling a two-step method to set and engage the two modules.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given herein below and the accompanying drawings, which are given by illustration only, and thus are not limitative of the present invention, and wherein:

The foregoing will be apparent from the following more particular description of example embodiments of the invention, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating embodiments of the present invention.

FIG. **1** is an example embodiment of the present invention that illustrates two interconnected modules.

FIG. **2** is an example embodiment of the present invention that illustrates the portable light in a separated configuration displaying the two modules.

FIG. **3** is an example embodiment of the present invention that illustrates a module and related components.

FIG. **4**(A) is an example embodiment of the present invention that illustrates an open socket and component.

FIG. **4**(B) is an example embodiment of the present invention that illustrates a lamp with interconnection components

FIG. **4**(C) is an example embodiment of the present invention that illustrates a clamp configured to interconnect with a lamp and other components of the supporting structure and an open socket configuration including a lamp and ballast connection.

FIG. **4**(D) is an example embodiment of the present invention that illustrates a closed socket configuration interconnecting the lamp and other components in a secure manner.

FIGS. **5**(A) and **5**(B) illustrate example embodiments of end caps of the present invention.

FIG. **6** illustrate example embodiments of a PC tube of the present invention.

FIG. **7** is an example embodiment of the present invention that illustrates multiple components of a first module and a second module during connection.

FIG. **8** is an example embodiment that illustrates an exploded view of components of one module of the present invention.

FIG. **9** illustrates an exploded view of components of a printed circuit board and ballast.

FIG. **10**(A) is an example embodiment that illustrates a radial connection of assembled components of the present invention.

FIG. **10**(B) is an example embodiment that illustrates a serial connection of assembled components of the present invention.

FIG. **10**(C) is an example embodiment that illustrates a parallel connection of assembled components of the present invention.

FIG. **11** is an example embodiment that illustrates an electromagnetic interference shield of the present invention.

FIG. **12** is an example embodiment that illustrates an exploded view of components in a second module of the present invention.

FIG. **13** is an example embodiment that illustrates a colored filter of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

As the exemplary embodiments may be implemented in several forms without departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its scope as defined in the appended claims. Therefore, various changes and modifications that fall within the scope of the claims, or equivalents of such scope are therefore intended to be embraced by the appended claims.

A description of example embodiments of the invention follows.

Example embodiments of the present invention meet the military requirements for performance specifications of portable fluorescent light sets as detailed in MIL-PRF-44259, Jun. 29, 2009 and additional amendments, which are hereby incorporated by reference in their entireties.

Example embodiments of the present invention include a portable light capable of being interconnected with additional portable light(s) of the same or similar design. The portable light is configured to be water resistant and contain a power supply cord in a fixed or semi-fixed external configuration. Further example embodiments of the present invention include a power cord with a NEMA 5-15 plug ("male component") on one end and a NEMA 5-15 connector/receptacle ("female component") on the opposing end. The power supply is provided via an activation on/off switch maintained in a switch housing for protection and ease of access. The power switch or activation switch can be attached to an end cap and contained in a tube, such as an aluminum tube to connect ballast side end cap, ballast, and socket. Further example embodiments of the present invention include a portable light being operable on at least a voltage of 120 to 240±5 volts alternating current at 50 to 60 Hertz (Hz)±5 Hz. Example embodiments of the present invention maintain a maximum input current draw per portable light of 0.7 amp. Example embodiments of the ballast maintain an input voltage of 100 to 110 VAC (50 to 60 Hz). Other specifications, voltages, and cable types may be interchanged, added, or removed as necessary without deviating from the scope of the invention. Example embodiments of the present invention may be scaled in order to increase or decrease the operability using different voltages.

FIG. **1** is an example embodiment **100** of the present invention that illustrates two modules interconnected. Example embodiment **100** includes a portable light **105**, which comprises a housing shield **160** that is interconnected with a first end cap **140** and a second end cap **150**.

Example embodiments of the present invention further include a T-shape molded power cable **121** with both male and female plugs at both ends. The power cable is attached to the outside of the shield housing and is attached via a method, such as recesses in the shield housing, tape, clamps, bands, or other forms of attachment (not shown) currently known or hereinafter developed that provide a secure connection between the power cable and shield housing. Alternative example embodiments allow for the power cable **121** to be placed in varying positions around or within the portable light **105** as may be required by differing circumstances. The power cable **121** is attached to a U-shape cable conduit **124** comprising a flexible material, semi-flexible material, or rigid material that is configured to hold the power cable **121** on an external side of the light set for easy installation and removal of the power cable **121**, as may be necessary for repairs, reconfigurations of light, and transport. Alternative example embodiments of the present invention may include a cable conduit or similar structure for affixing a power cable or other such cable, in a different configuration than a U-shape.

FIG. **2** is an example embodiment **200** of the present invention that illustrates two modules. Portable light **105** of the present invention consist of two modules **110** and **120** that comprise all necessary components of the portable light **105**. The present invention containing the two modules has advantages in the manufacturing process, assembly, reassembly, and repair because of the simplified construction, fewer steps to complete, and provides a more efficient way to conduct repairs. Other advantages include the ability to have a user having any degree of familiarity with the portable light be able to easily separate the two modules, replace a bulb, and reattach the two modules using alignment pins **151** and alignment grooves **152** that allow for automatic alignment of all components.

Further embodiments of the present invention include a clamp-style socket **59** that provides a secure and steady connection between the clamp-style socket **59** and bulb **130**. The clamp-style socket **59** further allows the bulb **130**, ballast housing **32**, socket (not shown), socket-side end cap **150**, and power cable **121** be unified into one module, such as a first module **110**.

Example embodiments of the portable light **105** of the present invention comprise two main modules. A first module comprising a socket-side end cap, ballast housing, a socket (not shown), an activation switch, and power supply cords (such as cable **121**) is assembled as a unity structure that is connected to a bulb **130** to form the first module **110**. A second module **120** comprises a housing shield **160** interconnected to a bulb-side end cap **140**.

The first module **110** is inserted into the second module **120** according to alignment groves **152** on the housing shield **160** and the mating alignment pins (not shown) of the end caps **140** and **150**. The two module system enables a user to separate the two main components in order to repair or replace component parts and easily reassemble the two main components by re-inserting the first module **110** into the second module **120**. The two modules easily separate from each other and the power supply cord can be removed and remounted as necessary.

FIG. **3** is an example embodiment **300** of the present invention that illustrates a module and related components. Example embodiments of the present invention connect the

fluorescent bulb to a ballast, such as a printed circuit board, in order to regulate current flow through the bulb. Examples may include an electronic ballast configured to be placed within an emissions containment housing that is further placed within a ballast housing. In some example embodiments, the separate emissions containment housing configured to specifically hold the electronic ballast, with emissions containment housing is further contained within the ballast housing **32** that is shown interconnected to the socket side end cap.

In example embodiments of the present invention, a ballast activation switch **20** is attached to the socket-side end cap **150** and is contained in the ballast housing **32** in order to connect the socket-side end cap **150**, ballast housing **32**, and clamp-style socket **59**.

In some example embodiments of the present invention, the bulb-side end cap **140** is a shock-absorbing end cap containing a plug integrated with the end cap that has at least one alignment pin in order to provide a direct alignment with the bulb being connected. Example embodiments of the present invention have at least two alignment mechanisms in each end cap, i.e., the socket-side end cap and the bulb-side end cap. Each alignment mechanism has a mating mechanism inside the housing. For example, the alignment pins of the end caps would pair with the alignment grooves **152** in the housing shield **160** (also referred to as a "housing tube").

Such example embodiments allow for simple installation and assembly under varying circumstances by enabling a user to connect the first module **110** and the second module **120** by aligning the pins **151** and grooves **152**. No other considerations or steps need be taken in order to reassemble the two modules.

Example embodiments of the cable conduit **124** are placed in locking grooves **152** or recessed mechanisms along the outside of the portable light **105** by placing the cable **121** into and securing it to the alignment grooves **152**. The cable and cable conduits can be coated or protected using different materials in order to protect against corrosion such that all cables and extraneous wiring are insulated with enough material to protect against abrasions.

Example embodiments of the present invention include mounting brackets or hardware to interconnect cables to the necessary components. Such hardware is capable of removal or change in position where necessary. In some example embodiments, two electrical cables are interconnected to the housing tube such that each side of the housing tube has a male and a female component.

FIG. **4**(A) is an example embodiment **400**A of the present invention that illustrates an open socket and component. At least one PCB (see FIG. **8**) is attached inside an emission containment housing that is placed inside a ballast housing **32**. The ballast housing **32** is interconnected with the bulb **130** via a terminal with through bores **43** located on one end for coupling with electrode pins **42** of the bulb. Alternative connection methods may be used in example embodiments of the present invention as may be necessary to connect a ballast housing **32** to a bulb **130**. In example embodiments of the present invention, the bulb (as shown in FIG. **4**A) is connected to the ballast housing **32** via a socket **40** of the first module of the portable light **105**. The socket **40** includes components to be interlocked in a manner that creates a secure and protected connection.

The interconnection of the bulb **130** and ballast housing **32** via the socket **40** enables addition protection from external and internal forces, such as turbulence, vibrations, shock, and other hazards that may be encountered during transportation and/or use of the portable light **105**.

Example embodiments of the clamp-style socket **59** of the present invention further include a disturbance-absorbing element **44**, such as a rubber pad, that is placed on the socket **40** to prevent the bulb **130** from slipping and to absorb any impact from external and internal movement. The disturbance absorbing element **44** may be constructed of multiple materials and/or sizes. Additional example embodiments of the clamp-style socket **59** of the present invention are configured to securely hold various lamp bases from different manufacturers.

Example embodiments of the present invention include a spring clip **41** that provides tension between the clamp **45** and the bulb **130**; the spring clip **41** also absorbs internal and external forces that may disturb or damage the bulb **130** or components attached to the bulb. The clip **41** is not limited to a spring clip, and may be substituted with other forms of attachment pieces or components that provide the required tension and support against impacts, shock, vibration, and other forces that may damage the portable light **105**.

Example embodiments of the present invention include a socket **40** that is interconnected with a clamp **45**, a spring clip **41**, and a shock-absorbing pad **44**. When the electrode pins **42** of the bulb are snapped into the through bores **43** of the ballast housing **32**, the base **46** of the bulb **130** is placed over the base of the socket such that a bulb base connector **48** engages a socket base connector **47** for additional stability. The base (not shown) of the bulb **130** is additionally placed on top of the shock-absorbing pad **44**, which provides additional stability and protection from external and internal forces acting upon the portable light **105**. Further example embodiments include a spring clip **41**, to ensure a tight fit between the socket **40** and the bulb **130** and provides for external protection of the bulb material. In alternative example embodiments of the present invention, the spring clip **41**, clamp **45**, and shock-absorbing pad **44** may be used in different configurations or made of different materials that are currently known or hereinafter developed.

Example embodiments of the present invention include the socket **40** comprising of a single material or multiple materials. The socket **40** may be comprised of polycarbonate, steel, acrylonitrile butadiene styrene (ABS), or other such materials currently known or hereinafter developed with high impact resistance, toughness, and heat resistance or other resilient material (thermoplastic).

Further example embodiments of the present invention include the clamp-style socket **59** comprising a clamp **45**, a clip **41**, and through-bores **43** for terminal connection in a single unitary socket, in which the clamp-style socket **59** is formed of the same material. Further example embodiments of the present invention include the socket **40** configured with an enlarged opening for receiving electrode pins **42** of the bulb **130** via longitudinal through-bores **43**.

FIG. **4**(B) is an example embodiment **400**B of the present invention that illustrates a bulb **130** with interconnection components including a bulb base connector **48** and a bulb base **46**. The types of bulbs used in example embodiments of the present invention are typically fluorescent lamp tubes. Other lamp tubes capable of reduced-emissions as are currently known or hereinafter developed may be interchanged. Typical fluorescent lamp tubes are a straight, elongated tube; however, alternative example embodiments of the bulb of the present invention can be constructed in different lengths, shapes, sizes, and configurations.

FIG. **4**(C) is an example embodiment **400**C of the present invention that illustrates an open socket configuration including a bulb **130** connected to a ballast housing **32** and a clamp **45** configured to interconnect with the bulb **130** and other

components of the supporting structure. In example embodiments of the present invention, the clamp **45** may include a clamp base connector **49** that is configured to engage with an additional connector component located on the bulb base **46** or surrounding area in different bulbs. Such connector components may be a male and a female locking mechanism that snap into place upon connection and closure. As example embodiments of the present invention can accommodate different lamp bases and bulb styles, the connector components may or may not be used depending on the structure of the bulb type and additional shapes or methods of combining or interconnecting the components may be used.

The bulb **130**, clamp-style socket **59**, and ballast housing **32** are further connected with a first end cap **150**. Example embodiments of the present invention include a first end cap **150** on the first module **110**, hereinafter referred to as a socket-side end cap **150**. The socket-side end cap **150** is configured to interconnect to the ballast housing **32**.

FIG. **4**(D) is an example embodiment **400**D of the present invention that illustrates a closed socket configuration interconnecting the bulb **130** with other components in a secure manner. The example embodiment **400**D illustrates that once a bulb **130** is connected with the ballast housing **32**, the clamp **45**, clip **41**, and socket **40** are engaged such that the ballast housing **32** is securely interlocked with the bulb **130**.

FIGS. **5**(A) and **5**(B) illustrate example embodiments of multiple end caps **140**, **150** of the present invention. The end caps of example embodiments of the present invention secure the two modules **110**, **120** of the portable light together with all or a portion of the other components. The end caps provide multiple functions that protect the portable light from internal and external disturbances and forces acting on the end cap(s), such as shock, dropping, transport, and vibration. Further functions provided by the end caps include securely holding the bulb and providing additional guide and alignment functions utilizing built-in features.

Example embodiments of the present invention include guide structures, such as alignment pins **151** and alignment grooves **152** (see FIG. **6**) that guide all components of the portable light **105** to the proper alignment and orientation of the portable light. Such guide structures may comprise other alignment techniques that enable reassembly of the portable light **105** such that the components cannot be reattached in an improper manner. This is beneficial for inexperienced users and experienced users alike and allows for simple and quick fool-proof reassembly.

FIG. **5**A is an example embodiment **500**A of the present invention that illustrates the bulb-side end cap **140**. Example embodiments of the bulb-side end cap **140** include a wrapping membrane **142** and studs **141***a* and **141***b* that securely attach the bulb **130** to the bulb-side end cap **140** in the proper orientation. The wrapping membrane **142**, stud(s) **141***a* and **141***b*, and a bulb-shaped plug **143** are recessed in the bulb-side end cap **140** to enable the bulb **130** to directly enter the space and be securely wrapped by supporting structures.

Example embodiments of the end cap(s) **140**, **150** further provide shock absorbing functions. Example embodiments of the bulb-side end cap **140** are configured in an octagonal shape to prevent the lamp assembly or bulb **130** from rolling within the portable light **105**; additional shapes may be used for the bulb-side end cap **140**.

Further example embodiments of the present invention include a shock-absorbing plug integrated with the bulb-side end cap **140**. The integrated shock-absorbing plug and alignment components enable a user to automatically align the first module **110** comprising the bulb **130** into the second module **120** with bulb-side end cap **140**. Alignment is vital since the socket **40** and lamp are configured in specific orientations.

Further example embodiments of the cap are configured into a unitary body such that the cap and bulb holder are a single piece. Example embodiments of the cap may comprise a wrapping membrane and supporting stud, such as studs **141***a* and **141***b*, to securely hold the lamp into a proper alignment that are configured as a single element of the same material.

FIG. **5**B is an example embodiment **500**B of the present invention that illustrates the socket-side end cap **150**. Further example embodiments of the present invention include at least one cap that is configured to absorb internal or external forces such as impact, shock, or vibration that may damage the lamp assembly during assembly, reassembly, or transport.

The socket-side end cap **150** may be configured in an octagon-like manner in order to prevent the lamp assembly from moving within the housing. Such an octagon-like molding is based on the specifications of the portable bulbs being used within the apparatus and such the cap shape could be modified to other shapes as may be currently used or hereinafter developed for the purposes disclosed herein without deviating from the scope of the invention. Further example embodiments of the present invention include a physical protection for membrane (portion) for the cable and push-button switch.

FIG. **6** illustrates an example embodiment **600** of a shield housing (e.g., PC tube) of the present invention. Example embodiments of the present invention include guide structures, such as alignment grooves **152** on the inside or outside of the shield housing to provide proper alignment and orientation of the portable light. The housing shield **160** is interconnected with the bulb-side end cap **140** of FIG. **5**A to create the second module **120** of the present invention. Example embodiments of the housing shield **160** can include a reflector system, a color filter, and/or an internal or external emissions filter either internally or externally, or some combination thereof (see FIG. **11**).

FIG. **7** is an example embodiment **700** of the present invention that illustrates multiple components of a first module **110** connected to a second module **120**. The first module **110** including the bulb **130**, the clamp-style socket **59** (which comprises of the spring **41**, the bulb base **46**, the clamp **45**, and the socket **40**), the ballast housing **32** (which can surround a filter PCB and/or a ballast PCB of FIG. **9**), and the socket-side end cap **150** are interlocked into the second module **120** using the alignment grooves **152** on the housing shield **160**. By interlocking the first module **110** and the second module **120**, the portable light **105** is complete.

FIG. **8** is an example embodiment **800** that illustrates an exploded view of components of the portable light **105** of one embodiment of the present invention. The example embodiment **800** illustrates at least some of the components incorporated in the first module **110** including guidelines to illustrate the method of combining the specified components. Specifically, in example embodiments of the present invention, a first module **110** includes a power cable **121** cord with a female end **122** and a male (not shown) that are interconnected via a cable conduit **124**. The socket-side end cap **150** is interconnected with a ballast housing **32**.

Example embodiments of the ballast housing **32** can include at least a printed circuit board, such as a ballast PCB **35** and an EMI filter PCB **55**, aligned in a holding tray **33** that is placed within the ballast housing **32**. The ballast housing **32** is capable of including a label or one may be affixed thereon

or therein, such as ballast label **170**. The ballast housing **32** has a first end connected to the socket-side end cap **150** via a first ballast cap **36***a*.

In some example embodiments, the socket-side end cap **150** is connected to the first ballast cap **36***a* via a gasket **39** to enhance sealing for humidity, which can be placed on both of the end caps; other methods of sealing out moisture may be used in place of the gasket **39**. Example embodiments of the present invention further interconnect the ballast housing **32** with a second ballast cap **36***b* that is further connected to the socket **40**, clamp **45**, rubber pad **44**, and spring **41**. Interconnections can be made with hardware **54** currently known or hereinafter developed, such as screws **51** or washers **52**.

FIG. **9** illustrates an exploded view **900** of components contained within the ballast housing **32** of an example embodiment of the present invention. Example embodiments of the present invention include at least one printed circuit board (PCB), such as ballast PCB **35** that is set into a holding tray or component that efficiently holds the ballast PCB **35** and a filter circuit, such as EMI filter PCB **55**, in a manner that saves room and assembly time. Example embodiments of the holding tray **33** are configured in an open manner such that the holding tray may be separated from the PCB **35** for easy repair and inspection.

Example embodiments of the present invention are configured to implement a filter circuit to reduce EMI emissions without the need of additional insulating layers or extraneous components. Example embodiments of the present invention include an EMI filter **55** to reduce the EMI signal by electronic filtering. For example, the filter PCB **55** can be configured with Ferrite bead **37** in order provide a passive electronic component used to suppress high frequency noise in electronic circuits. The filter PCB **55** can be used to prevent or help prevent EMI noise through power connections. In some example embodiments, the Ferrite bead **37** may interconnected with hardware components used for strain relief, such as component **53**. Where the ballast PCB **35** and the filter PCB **55** are separate circuits interconnected.

Further example embodiments of the present invention include the holding tray **33** and hardware **54** comprised of electrically conductive material, such that the holding tray **33** and hardware **54** (or other attachment pieces) work as electrical grounds or earth to eliminate ground wiring. Such electrical grounding characteristic of the holding tray **33** saves time and cost of the components. Example embodiments of the holding tray **33** include end caps **36***a* and **36***b* at proximal ends of the tray that comprise electrically conductive material. When the holding tray **33** is assembled with the ballast housing **32**, the ballast PCB **35** and filter PCB **55** is covered by an electrically conductive material that provides for omnidirectional conductivity.

FIG. **10**(A) is an example embodiment that illustrates a radial connection of assembled components of portable light **105** according to one embodiment of the present invention. FIG. **10**(B) is an example embodiment that illustrates a serial connection of assembled components of portable light **105** according to one embodiment of the present invention. FIG. **10**(C) is an example embodiment that illustrates a parallel connection of assembled components of portable light **105** according to one embodiment of the present invention. Easy to organize end power cables **121** include mechanisms to provide a variety of wiring functions and shapes for different configurations of the portable light **105** in assembly.

For example, some such configurations could include connecting multiple work light structures in a radial assembly (FIG. **10**A) that may be similar to a hub-and-spoke pattern that collapses in the center for ease of transport. Other such structures could include a serial assembly or a parallel assembly of multiple work light structures.

Example embodiments of the portable light **105** may be used individually or interconnected with additional portable lights **105**. When multiple portable lights **105** are interconnected, each portable light **105** is able to be individually controlled, e.g., the portable light **105** can be activated and deactivated on a per-portable light basis. In other example embodiments, interconnected portable lights **105** are configured to be operated as a single unit, e.g., all portable light **105** in the interconnected assembly may be activated and deactivated as a group. Further example embodiments of the present invention enable each portable light **105** to be individually controlled to increase or decrease the intensity of the visible lights. Further example embodiments of the present invention include a portable light interconnected to additional portable light **105** in order to provide power via the light assembly to the next light assembly when connected in series regardless of the position of the power switch of each portable light **105**.

Alternative example embodiments of the present invention include interconnecting multiple portable lights **105** while plugged into (connected to) a ground fault circuit interrupter (GFCI). Further example embodiments include each portable light **105** in an assembly of multiple portable lights **105** operating independently on the through power circuit.

FIG. **11** is an example embodiment **1100** that illustrates an electromagnetic interference (EMI) emissions shield **180** according to one embodiment of the present invention. Example embodiments of an EMI shield **180** can be formed out of metal or other grounding substances that allow for the EMI shield **180** to be electrically grounded via its connection with a ballast ground. Example embodiment of the EMI shield **180** may be used to collect EMI noise emitted into the air interface. The EMI shield **180** and containment housing (not shown) enable the EMI signal to be returned to the ground by connecting the containment housing with the ground unit. Example embodiments of the present invention using two notches **181** enable the EMI shield **180** to be easily aligned with the housing shield **160**.

Further example embodiments of the present invention include a reflector component **61** that also includes guide structures for alignment of the reflector **61** with the EMI shield **180** when the reflector is connected with or wrapped around the surface of the EMI shield **180**. In example embodiments of the present invention, a light reflector **61** is configured to be easily placed within the internal portion of the housing shield **160** of the second module **120** as in FIG. **1**. The reflector is configured with at least two notches placed at proximal ends of the reflector in order to allow easy alignment with the EMI filter when the reflector is wrapped around the surface of the EMI filter. Example embodiments of the reflector may include a reflector on the housing shield to better heat dispensing of a bulb and reduce distortion or aging from heat.

Further example embodiments of the present invention include a reflector consisting of two layers. A front side layer is a printable surface that is made of a white plastic sheet and the back side layer is a reflective surface that is made of metalized plastic or high reflective materials. The reflector layers serve multiple purposes; including providing places for labels indicating instructions for interchanging or replacing components of the portable light **105**.

Alternative embodiments of the present invention include additional or different alignment guides and the reflector may consist of other materials as may best suit the circumstances. Alternative embodiments of the present invention further include a light reflector being placed in other locations on or in the first module **110** or the second module **120** and the light

reflector may be added or removed as necessary. In some such example embodiments, the light reflector **61** attached to the inside of the housing tube allows for improved heat dispensing and the reduction of distortion and aging due to the heat of the bulb.

FIG. **12** is an example embodiment **1200** that illustrates an exploded view of a second module **120** of the portable light **105** of one embodiment of the present invention. The example embodiment **1200** illustrates at least some of the components that may be incorporated in the second module, such as module **120** in FIG. **2**. Specifically, in example embodiments of the present invention, the second module **120** includes a housing shield **160** being of appropriate size to encompass at least the components of a first module, such as module **110**, and further including a reflector **61** and an EMI shield **180** (as in FIG. **11**). The EMI shield **180** and/or reflector **61** may be inserted in the housing shield **160**, and a cable conduit, such as U-shaped cable conduit **124** may be interconnected to the outside surface of the housing shield. The conduit **24** may be affixed to the components in different orientations as required.

Alternative example embodiments of the present invention include the housing shield **160**, and inserted contents, being connected with a first end cap, such as the bulb side end cap **140** in FIG. **5**A. The housing shield can be connected the bulb side end cap with additional components liking the two components, such as a gasket **39**. The cable conduit **124** is configured to align with cable conduit recesses **125** on the end cap. A cable tie **38** is further interconnected with the end cap **140** in order to improve the connection seal.

FIG. **13** is an example embodiment **1300** that illustrates a colored filter, such as a blue filter **91**, to reduce light according to one embodiment of the present invention. Example embodiments of the present invention include a filter to reduce the illumination of the portable light **105**. Some example embodiments of the filter comprise polyethylene terephthalate (PET). Other example embodiments may comprise other semi-rigid to rigid lightweight materials as currently known in the art or hereinafter developed. Example embodiment **1300** includes an example of the portable light **105**, such as the portable light **105** in FIG. **1**, and the colored filter, such as a blue colored filter **91**, that can be place over or around the portable light in full or in part. The colored filter **91** may include other colors, alone or in combination, that are used to reduce light illumination for the purpose of covering the portable light.

Alternative example embodiments of the present invention can include a PCB holding part efficiently holds ballast PCB and filter PCB to save volume and assembly time. Attaching PCB in the tube is very difficult but tray is separated and open structure to make easy to assemble and repair. PCB holding part and screws were made electrically conductive material, so it works as electrical ground or earth to eliminate ground wiring. It saves time and cost. Alternative example embodiments further include a PCB holding part has cap of both end of tube with electrically conductive material. Once PCB holding part is assembled with the tube, PCBs is covered by electrically conductive material omni-directionally. PCB holding part and tube work as an omni-direct.

While this invention has been particularly shown and described with references to example embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the invention encompassed by the appended claims.

What is claimed is:

1. A portable light comprising:
a removable bulb;
a first module comprising a ballast housing, a ballast, a filter circuit, a socket segment, a gasket, an end cap, a cable tie, and a power supply cord interconnected with the removable bulb; and
a second module comprising a shield housing, a reflector, an electromagnetic interference (EMI) shield, a gasket, an end cap, and a cable tie,
wherein the first module is configured to be directly inserted into the second module.

2. The portable light of claim **1**, wherein:
the socket segment comprises a clamp, a clip, throughbores, and a socket to form a unitary body, and
the unitary body comprises of a single material.

3. The portable light of claim **2** wherein the socket segment comprises a clamp-style socket configured to lock the ballast housing to the removable bulb.

4. The portable light of claim **1**, further comprising a light reflector located in the shield housing and configured to distribute light and disperse bulb heat and reduce distortion or aging.

5. The portable light of claim **1**, wherein the first module further comprises the removable bulb, a switch, a cap, and the power supply cable in a unitary body.

6. The portable light of claim **1**, wherein the first module comprises an alignment pin located on a first side and a second side, the alignment pins configured to interconnected with an alignment groove located on the second module.

7. The portable light of claim **1**, wherein the first module and the second module are each configured to be separated in order to facilitate bulb replacement.

8. The portable light of claim **1**, wherein the power supply cord is located external to the first module and is configured to separate from the shield housing.

9. The portable light of claim **1**, further comprising a reflector attached within the shield housing.

10. The portable light of claim **1** further comprising an emissions containment housing for the ballast, the emissions housing located within the shield housing, wherein the ballast comprises an electronic ballast and filter printed circuit board.

11. The portable light of claim **1**, further comprising a cap that includes a guide mechanism configured to align components of the first and second modules in a same orientation at time of assembly or reassembly.

12. The portable light of claim **11**, wherein the cap is configured to absorb internal and external forces.

13. The portable light of claim **11**, wherein:
the cap is configured to incorporate at least two functions into a single structure; and
the single structure supports at least one stud, is configured to hold the removable bulb in place, and contains a wrapping membrane.

14. The portable light of claim **1**, wherein at least the first module or the second module is configured to provide protection for an on/off switch.

15. The portable light of claim **1**, further comprising a blue filter configured to interconnect with the removable bulb.

16. The portable light of claim **1**, further comprising a cable conduit configured to attach to the first module, wherein the cable conduit comprises a U-shape cable conduit of a flexible material.

17. The portable light of claim **1**, wherein the portable light is configured to interconnect in at least a serial configuration, a parallel configuration, or a radial configuration with at least one other portable lights.

18. The portable light of claim **17**, wherein the portable light is inter-operably assembled with the at least one other portable light to be controlled individually or as a part of a group of portable lights.

19. The portable light of claim **1**, wherein:

the removable bulb is a fluorescent bulb; and

the ballast is an electronic ballast configured to control the removable fluorescent bulb.

20. The portable light of claim **1**, wherein the portable light is configured to connect with at least one light of a similar configuration.

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